

What is claimed is:

1. A polishing method for polishing a film of an object to be polished having a substrate, an insulating film formed in the substrate, interconnection grooves  
5 formed in the insulating film, and said film, that is, an interconnection layer, formed inside and outside of the interconnection grooves comprising

supplying a processing solution over the surface to be polished at least substantially parallel to  
10 that surface and removing by polishing the film formed outside of the interconnection grooves by a shear stress due to the processing solution preferentially from projecting portions of said film to flatten the surface.

2. A polishing method as set forth in claim 1,  
15 wherein the film comprises a copper film.

3. A polishing method as set forth in claim 1, wherein the object to be polished is made an object having contact holes communicating with the interconnection grooves formed in the insulating film and  
20 having the interconnection layer formed buried inside the contact holes as well.

4. A polishing method as set forth in claim 1, further comprising  
using a processing solution containing at least  
25 a chelating agent as the processing solution;

chelating the surface part of the film by the  
chelating agent to form a chelate film;

removing by polishing preferentially projecting  
portions of the chelate film by the shear stress of the  
5 processing solution; and

repeatedly again forming a chelate film on the  
surface parts of the film exposed at the projecting  
portions and removing by polishing preferentially the  
projecting portions of the chelate film to flatten the  
10 film.

5. A polishing method as set forth in claim 4,  
further comprising

using a polishing solution further including an  
oxidizing agent as said polishing solution and  
15 oxidizing the surface part of the film by said  
oxidizing agent and chelating the obtained oxide by said  
chelating agent to form a chelate film.

6. A polishing method as set forth in claim 4,  
further comprising

20 using a polishing solution further including a  
surface-active agent as said polishing solution and

removing said chelate as micelles covered by  
said surface-active agent when removing by polishing from  
projecting portions of said chelate film by the shear  
25 stress by said processing solution.

7. A polishing method for an object having a film on a surface to be polished, comprising supplying an electrolytic solution at least between said surface to be polished and a cathode member arranged facing said surface and substantially parallel to said surface while supplying voltage with the cathode member as a cathode and said film as an anode to remove by polishing preferentially projecting portions of said film by the shear stress of the electrolytic solution to flatten the surface.

8. A polishing method as set forth in claim 7, wherein the film comprises a copper film.

9. A polishing method as set forth in claim 7, further comprising using as the object to be polished an object having a substrate, an insulating film formed on said substrate, interconnection grooves formed on the insulating film, and said film, that is, an interconnection layer, buried inside the interconnection grooves and formed over the entire surface outside the interconnection grooves, and

removing by polishing the film, that is, interconnection layer, formed outside of the interconnection grooves to flatten the surface.

10. A polishing method as set forth in claim 9,

wherein the object to be polished is made an object  
having contact holes communicating with the  
interconnection grooves formed in the insulating film and  
having the interconnection layer formed buried inside the  
5 contact holes as well.

11. A polishing method as set forth in claim 7,  
further comprising

using an electrolytic solution containing at  
least a chelating agent as the electrolytic solution;

10 supplying a voltage with said cathode member as  
a cathode and said film as an anode to oxidize the  
surface of the film by anodic oxidation;

chelating the surface part of the oxidized film  
by the chelating agent to form a chelate film;

15 removing by polishing preferentially projecting  
portions of the chelate film by the shear stress of the  
electrolytic solution; and

repeatedly again forming a chelate film on the  
surface parts of the film exposed at the projecting  
20 portions and removing by polishing preferentially the  
projecting portions of the chelate film to flatten the  
interconnection layer.

12. A polishing method as set forth in claim 11,  
further comprising

25 using an electrolytic solution further

including a surface-active agent as said electrolytic solution and

removing said chelate as micelles covered by said surface-active agent when removing by polishing from  
5 projecting portions of said chelate film by the shear stress by said electrolytic solution.

13. A polishing apparatus for polishing an object having a film on a surface to be polished,

comprising a processing solution supplying  
10 means for supplying a processing solution over the surface to be polished at least substantially parallel to that surface and

removing by polishing the film formed outside of the interconnection grooves by a shear stress due to  
15 the processing solution preferentially from projecting portions of said film to flatten the surface.

14. A polishing apparatus as set forth in claim 13, which polishes an object wherein the film comprises a copper film.

20 15. A polishing apparatus as set forth in claim 13, which supplies a processing solution containing at least a chelating agent from said processing solution supplying means.

16. A polishing apparatus as set forth in claim 15,  
25 which supplies a processing solution further containing

an oxidizing agent from said processing solution  
supplying means.

17. A polishing apparatus as set forth in claim 15,  
which supplies a processing solution further containing a  
5 surface-active agent from said processing solution  
supplying means.

18. A polishing apparatus for an object having a  
film on a surface to be polished, comprising  
a cathode member arranged facing said surface;  
10 an electrolytic solution supplying means for  
supplying an electrolytic solution between said surface  
and said cathode member and over said surface at least  
substantially parallel to said surface; and  
a power supply for supplying voltage with said  
15 cathode member as a cathode and said film as an anode and  
removing by polishing preferentially projecting  
portions of the film by the shear stress of the  
processing solution.

19. A polishing apparatus as set forth in claim  
20 18, which polishes an object wherein the film comprises a  
copper film.

20. A polishing apparatus as set forth in claim 18,  
which supplies an electrolytic solution containing at  
least a chelating agent from an electrolytic solution  
25 supplying means.

21. A polishing apparatus as set forth in claim 20,  
which supplies an electrolytic solution further  
containing a surface-active agent from said processing  
solution supplying means.

5        22. A polishing apparatus as set forth in claim 20,  
wherein said power supply is a direct current power  
supply which supplies a predetermined voltage with said  
cathode member as a cathode and said film as an anode.

10       23. A polishing apparatus as set forth in claim 21,  
wherein said power supply is a direct current power  
supply which supplies a predetermined voltage with said  
cathode member as a cathode and said film as an anode.

15       24. A polishing apparatus as set forth in claim 22,  
wherein said direct current power supply supplies a  
pulse-like voltage having a predetermined period.

25. A polishing apparatus as set forth in claim 23,  
wherein said direct current power supply supplies a  
pulse-like voltage having a predetermined period.

20       26. A polishing apparatus as set forth in claim 20,  
wherein

      said apparatus further comprises an anode  
member facing said surface to be polished and separated  
from said cathode member by a predetermined distance;

      said electrolytic solution supplying means  
25    supplies an electrolytic solution between said surface

and said cathode member and between said surface and said anode member; and

said power supply supplies voltage to said cathode member and said anode member.

5           27. A polishing apparatus as set forth in claim 21, wherein

said apparatus further comprises an anode member facing said surface to be polished and separated from said cathode member by a predetermined distance;

10           said electrolytic solution supplying means supplies an electrolytic solution between said surface and said cathode member and between said surface and said anode member; and

15           said power supply supplies voltage to said cathode member and said anode member.

28. A polishing apparatus as set forth in claim 26, wherein said anode member is comprised of a nobler metal than the material of said film.

20           29. A polishing apparatus as set forth in claim 27, wherein said anode member is comprised of a nobler metal than the material of said film.

30. A polishing apparatus as set forth in claim 20, further comprising an ammeter for measuring the value of a current flowing between said cathode member and said film.

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31. A polishing apparatus as set forth in claim 21, further comprising an ammeter for measuring the value of a current flowing between said cathode member and said film.

5        32. A polishing apparatus as set forth in claim 30, further comprising a controller for controlling the voltage supplied by said power supply so that the current value obtained from said ammeter becomes constant.

10       33. A polishing apparatus as set forth in claim 31, further comprising a controller for controlling the voltage supplied by said power supply so that the current value obtained from said ammeter becomes constant.

15       34. A polishing apparatus as set forth in claim 30, which manages progress of polishing of said film by a direct current value obtained from said ammeter.

35. A polishing apparatus as set forth in claim 31, which manages progress of polishing of said film by a direct current value obtained from said ammeter.